

Choking/Obstructed Airway

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Introduction

Choking occurs when the airway is blocked due to a foreign body at the larynx or due to laryngospasm. Possible mechanisms for choking and obstructed airway during space flight may include accidental inhalation of food particles while eating^[1] or inhalation of a foreign body suspended in microgravity,^[2] either of which may obstruct the airway or irritate the vocal cords and cause laryngospasm. Treatment includes the Heimlich maneuver, inspection and removal of the foreign body, chest compressions, and ventilation. If these efforts are unsuccessful, surgical intervention is necessary.^[3]

Clinical Priority and Clinical Priority Rationale by Design Reference Mission

One of the inherent properties of space flight is a limitation in available mass, power, and volume within the space craft. These limitations mandate prioritization of what medical equipment and consumables are manifested for the flight, and which medical conditions would be addressed. Therefore, clinical priorities have been assigned to describe which medical conditions will be allocated resources for diagnosis and treatment. “Shall” conditions are those for which diagnostic and treatment capability must be provided, due to a high likelihood of their occurrence and severe consequence if the condition were to occur and no treatment was available. “Should” conditions are those for which diagnostic and treatment capability should be provided if mass/power/volume limitations allow. Conditions were designated as “Not Addressed” if no specific diagnostic and/or treatment capability are expected to be manifested, either due to a very low likelihood of occurrence or other limitations (for example, in medical training, hardware, or consumables) that would preclude treatment. Design Reference Missions (DRMs) are proposed future missions designated by a set of assumptions that encompass parameters such as destination, length of mission, number of crewmembers, number of Extravehicular Activities (EVAs), and anticipated level of care. The clinical priorities for all medical conditions on the Exploration Medical Condition List (EMCL) can be found here (https://humanresearchwiki.jsc.nasa.gov/index.php?title=Category:All_DRM). The EMCL document may be accessed here (https://humanresearchwiki.jsc.nasa.gov/images/6/62/EMCL_RevC_2013.pdf).

Design Reference Mission	Clinical Priority	Clinical Priority Rationale
<p>Lunar sortie mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 4 crewmembers (3 males, 1 female) 14 days total 4 EVAs/ crewmember <u>Level of Care 3</u> 	Not Addressed	The likelihood of an obstructed airway occurring during a lunar sortie mission is very low. In addition, an obstructed airway not responsive to the Heimlich maneuver requires surgical intervention (cricothyrotomy or tracheotomy) and this capability will not be manifested on the space craft. Therefore, this medical condition will not be specifically addressed by the medical system.
<p>Lunar outpost mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 4 crewmembers (3 males, 1 female) 180 days total 90 EVAs/ crewmember <u>Level of Care 4</u> 	Shall	Treatment for an obstructed airway, if not responsive to the Heimlich maneuver, requires surgical intervention (cricothyrotomy or tracheotomy). Due to the long-duration nature of the lunar outpost mission, and based on current flight data as used by the Integrated Medical Model (IMM), the likelihood of this condition occurring is relatively high. Therefore, treatment capability shall be manifested.
<p>Near-Earth Asteroid (NEA) mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 3 crewmembers (2 males, 1 female) 395 days total 30 EVAs/ crewmember <u>Level of Care 5</u> 	Shall	Treatment for an obstructed airway, if not responsive to the Heimlich maneuver, requires surgical intervention (cricothyrotomy or tracheotomy). Due to the long-duration nature of the NEA mission, and based on current flight data as used by IMM, the likelihood of this condition occurring is relatively high. Therefore, treatment capability shall be manifested.

Initial Treatment Steps During Space Flight

A link is provided to a prior version of the International Space Station (ISS) Medical Checklist, which outlines the initial diagnostic and treatment steps recommended during space flight for various conditions which may be encountered onboard the ISS. Further diagnostic and treatment procedures beyond the initial steps outlined in the Medical Checklist are then recommended by the ground-based Flight Surgeon, depending on the clinical scenario. Please note that this version does not represent current diagnostic or treatment capabilities available on the ISS.

While more recent versions of this document are not accessible to the general public, the provided version of the checklist can still provide a general sense of how medical conditions are handled in the space flight environment. Medical Checklists will be developed for exploration missions at a later point in time.

Please note this file is over 20 megabytes (MB) in size, and may take a few minutes to fully download.

ISS Medical Checklist (http://www.nasa.gov/centers/johnson/pdf/163533main_ISS_Med_CL.pdf)

Capabilities Needed for Diagnosis

The following is a hypothetical list of capabilities that would be helpful in diagnosis. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Vital signs measurement capability (blood pressure, pulse, respiratory rate, pulse oximetry, as required per the patient's clinical state)
- Auscultation device (such as a stethoscope)

Capabilities Needed for Treatment

The following is a hypothetical list of capabilities that would be helpful in treatment. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Crew medical restraint system
- Laryngoscope
- Forceps
- Cricothyrotomy/Tracheostomy Kit
- Personal protective equipment
- Ventilator
- Supplemental oxygen
- Intubation kit
- Ambu bag and mask

Associated Gap Reports

The NASA Human Research Program (HRP) identifies gaps in knowledge about the health risks associated with human space travel and the ability to mitigate such risks. The overall objective is to identify gaps critical to human space missions and close them through research and development. The gap reports that are applicable to this

medical condition are listed below. A link to all of the [HRP gaps](http://humanresearchroadmap.nasa.gov/Gaps/) can be found here (<http://humanresearchroadmap.nasa.gov/Gaps/>).

- 2.01 - We do not know the quantified health and mission outcomes due to medical events during exploration missions.
- 2.02 - {[2.02 Title]}
- 3.01 - We do not know the optimal training methods for in-flight medical conditions identified on the Exploration Medical Condition List taking into account the crew medical officer's clinical background. (Closed)
- 3.03 - We do not know which emerging technologies are suitable for in-flight screening, diagnosis, and treatment during exploration missions.
- 4.01 - We do not have the capability to provide a guided medical procedure system that integrates with the medical system during exploration missions.
- 4.02 - We do not have the capability to provide non-invasive medical imaging during exploration missions.
- 4.04 - We do not have the capability to deliver supplemental oxygen to crew members while minimizing local and cabin oxygen build-up during exploration missions.
- 4.09 - We do not have the capability to provide medical suction and fluid containment during exploration missions.
- 4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions.
- 4.15 - Lack of medication usage tracking system that includes automatic time stamping and crew identification
- 4.17 - We do not have the capability to package medications to preserve stability and shelf-life during exploration missions.
- 4.19 - We do not have the capability to monitor physiological parameters in a minimally invasive manner during exploration missions.
- 4.23 - We do not have the capability to auscultate, transmit, and record body sounds during exploration missions.
- 4.24 - Lack of knowledge regarding the treatment of conditions on the Space Medicine Exploration Medical Condition List in remote, resource poor environments (Closed)
- 5.01 - We do not have the capability to comprehensively manage medical data during exploration missions.

Other Pertinent Documents

List of Acronyms

D	
DRM	Design Reference Mission
E	
EMCL	Exploration Medical Condition List
EVA	Extravehicular Activity
I	
ISS	International Space Station
M	
MB	Megabyte
N	
NEA	Near Earth Asteroid

References

1. Merck Manual. Pulmonary Disorders, Stridor. Porter RS, editor. 2006. Whitehouse Station, N.J, Merck Sharp & Dohme Corp.
2. Integrated Medical Model. Choking/Obstructed Airway. Accessed 2011 Oct. (Internal NASA document – Not publicly available).
3. International Space Station Integrated Medical Group. Medical Checklist ISS - All Expeditions. Houston: National Aeronautics and Space Administration; 2008 (Internal NASA document – Not publicly available).

Last Update

This topic was last updated on 8/14/2014 (Version 2).

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Category: Medical Conditions

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